

# SEQUENCE LISTING

- <110> Walker, David H.  
Yu, Xu-Jie
- <120> *Ehrlichia chaffeensis* 28 kDa Outer Membrane  
Protein Multigene Family
- <130> D6311
- <141> 2001-05-01
- <150> 60/201,035  
<151> 2000-05-01
- <160> 53
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- <220>  
<223> P28-1 Outer Membrane Protein of  
*Ehrlichia chaffeensis*
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Ile	Leu	Phe	Thr	Pro	His	Ile	Ser	Leu	Ala	Ser	Val	Leu	Asn	Asp
				20					25				30	

His	Asn	Ser	Met	Tyr	Val	Gly	Ile	Gln	Tyr	Lys	Pro	Ala	Arg	Gln	
				35					40					45	
His	Leu	Ser	Lys	Leu	Leu	Ile	Lys	Glu	Ser	Ala	Ala	Asn	Thr	Val	
				50					55					60	
Glu	Val	Phe	Gly	Leu	Lys	Lys	Asp	Leu	Leu	Asn	Asp	Leu	Leu	Thr	
				65					70					75	
Gly	Ile	Lys	Asp	Asn	Thr	Asn	Phe	Asn	Ile	Lys	Tyr	Asn	Pro	Tyr	
				80					85					90	
Tyr	Glu	Asn	Asn	Arg	Leu	Gly	Phe	Ser	Gly	Ile	Phe	Gly	Tyr	Tyr	
				95					100					105	
Tyr	Asn	Lys	Asn	Phe	Arg	Ile	Glu	Ser	Glu	Leu	Ser	Tyr	Glu	Thr	
				110					115					120	
Phe	His	Ile	Lys	Asn	Asn	Gly	Tyr	Lys	Arg	Ile	Asp	Cys	Glu	Lys	
				125					130					135	
His	Phe	Ala	Leu	Ala	Lys	Glu	Ile	Ser	Gly	Gly	Ser	Asn	Asn	Pro	
				140					145					150	
Ala	Asn	Asn	Lys	Tyr	Val	Thr	Leu	Ile	Asn	Asn	Gly	Ile	Ser	Leu	
				155					160					165	
Thr	Ser	Ala	Leu	Ile	Asn	Val	Cys	Tyr	Asp	Val	Asp	Gly	Leu	Lys	
				170					175					180	
His	Asn	Ile	Ile	Thr	Tyr	Ser	Cys	Leu	Gly	Phe	Gly	Val	Asp	Thr	
				185					190					195	
Ile	Asp	Phe	Leu	Ser	Lys	Tyr	Thr	Thr	Lys	Phe	Ser	Tyr	Gln	Gly	
				200					205					210	
Lys	Leu	Gly	Ala	Ser	Tyr	Thr	Val	Ser	Pro	Gln	Val	Ser	Val	Phe	
				215					220					225	
Ile	Glu	Gly	Tyr	Tyr	His	Gly	Leu	Phe	Gly	Lys	Lys	Phe	Glu	Lys	
				230					235					240	
Ile	Pro	Val	Asn	Tyr	Pro	Cys	Asp	Tyr	Pro	Ser	Pro	Thr	Pro	Pro	
				245					250					255	

Asn Ser Lys Pro His Val His Thr Thr Ala Leu Ala Met Leu Ser  
 260 265 270

Ile Gly Tyr Tyr Gly Gly Ser Ile Gly Ile Lys Phe Ile Leu  
 275 280

<210> 2

<211> 297

<212> PRT

<213> *Ehrlichia chaffeensis*

<220>

<223> P28-2 Outer Membrane Protein of  
*Ehrlichia chaffeensis*

<400> 2

Met Ser Tyr Ala Lys Val Phe Ile Leu Ile Cys Leu Ile Leu Leu  
 5 10 15

Val Pro Ser Leu Ser Phe Ala Ile Val Asn Asn Asp Phe Leu Lys  
 20 25 30

Asp Asn Ile Gly His Phe Tyr Ile Gly Gly Gln Tyr Lys Pro Gly  
 35 40 45

Val Pro Arg Phe Asn Arg Phe Leu Val Thr Asn Asn Asn Ile Arg  
 50 55 60

Glu Leu Met Ser Ser Asp Glu Glu Cys Arg Ser Thr Ile Pro His  
 65 70 75

Met Val Gln Ser Val Ala Gln Gly Thr Leu Pro Pro Glu Ala Leu  
 80 85 90

Glu Glu Leu Ala Asp Gly Lys Phe Pro Glu Gly Tyr Leu Tyr Phe  
 95 100 105



<213>      *Ehrlichia chaffeensis*

<220>

<223>      P28-3 Outer Membrane Protein of  
            *Ehrlichia chaffeensis*

<400>      3

Met	Gln	Lys	Leu	Tyr	Ile	Ser	Phe	Ile	Ile	Leu	Ser	Gly	Leu	Leu	
				5					10					15	
Leu	Pro	Lys	Tyr	Val	Phe	Cys	Met	His	Gln	Asn	Asn	Asn	Ile	Asp	
				20					25					30	
Gly	Ser	Tyr	Val	Thr	Ile	Lys	Tyr	Gln	Leu	Thr	Thr	Pro	His	Phe	
				35					40					45	
Lys	Asn	Phe	Tyr	Ile	Lys	Glu	Thr	Asp	Phe	Asp	Thr	Gln	Glu	Pro	
				50					55					60	
Ile	Gly	Leu	Ala	Lys	Ile	Thr	Ala	Asn	Thr	Lys	Phe	Asp	Thr	Leu	
				65					70					75	
Lys	Glu	Asn	Phe	Ser	Phe	Ser	Pro	Leu	His	Gln	Thr	Asp	Ser	Tyr	
				80					85					90	
Lys	Ser	Tyr	Gln	Asn	Asp	Leu	Leu	Gly	Ile	Gly	Leu	Ser	Val	Gly	
				95					100					105	
Leu	Phe	Val	Lys	Ser	Phe	Arg	Ile	Glu	Phe	Glu	Gly	Ala	Tyr	Lys	
				110					115					120	
Asn	Phe	Asn	Thr	Lys	Arg	Leu	Ala	Arg	Tyr	Lys	Ser	Lys	Asp	Gly	
				125					130					135	
Tyr	Lys	Tyr	Phe	Ala	Ile	Pro	Arg	Lys	Ser	Glu	His	Gly	Phe	Leu	
				140					145					150	
Asp	Asn	Thr	Phe	Gly	Tyr	Thr	Val	Ala	Lys	Asn	Asn	Gly	Ile	Ser	
				155					160					165	
Ile	Ile	Ser	Asn	Ile	Ile	Asn	Leu	Cys	Ser	Glu	Thr	Lys	Tyr	Lys	
				170					175					180	

Ser Phe Thr Pro Tyr Ile Cys Ile Gly Val Gly Gly Asp Phe Ile  
185 190 195

Glu Ile Phe Asp Val Met Arg Ile Lys Phe Ala Tyr Gln Gly Lys  
200 205 210

Val Gly Val Ser Tyr Pro Ile Thr Ser Lys Leu Ile Leu Ser Ile  
215 220 225

Asn Gly Gln Tyr His Lys Val Ile Gly Asn Lys Phe Glu Leu Leu  
230 235 240

Pro Val Tyr Gln Pro Val Glu Leu Lys Arg Leu Val Thr Asn Lys  
245 250 255

Thr Ser Lys Asp Ile Asp Gln Asp Val Thr Ala Ser Leu Thr Leu  
260 265 270

Asn Leu Glu His Phe Ser Ser Glu Ile Gly Leu Ser Phe Ile Phe  
275 280 285

<210> 4

<211> 272

<212> PRT

<213> *Ehrlichia chaffeensis*

<220>

<223> P28-4 Outer Membrane Protein of  
*Ehrlichia chaffeensis*

<400> 4

Met Tyr Met Tyr Asn Lys Lys His Tyr Cys Tyr Ile Val Thr Tyr  
5 10 15

Val Ile Thr Leu Phe Phe Leu Leu Leu Pro Ile Glu Ser Leu Ser  
20 25 30

Ala Leu Ile Gly Asn Val Glu Lys Asp Leu Lys Val Ser Ser Thr  
35 40 45

Tyr	Val	Ser	Ser	Gln	Tyr	Lys	Pro	Ser	Ile	Phe	His	Phe	Arg	Asn	
				50					55					60	
Phe	Ser	Ile	Gln	Glu	Ser	His	Pro	Lys	Lys	Ser	Ser	Glu	Glu	Phe	
				65					70					75	
Lys	Lys	Ile	Lys	Ala	Asn	Leu	Asn	Asn	Ile	Leu	Lys	Ser	Asn	Ala	
				80					85					90	
Tyr	Asn	Leu	Gln	Phe	Gln	Asp	Asn	Thr	Thr	Ser	Phe	Ser	Gly	Thr	
				95					100					105	
Ile	Gly	Tyr	Phe	Ser	Lys	Gly	Leu	Arg	Leu	Glu	Ala	Glu	Gly	Cys	
				110					115					120	
Tyr	Gln	Glu	Phe	Asn	Val	Lys	Asn	Ser	Asn	Asn	Ser	Leu	Ile	Ile	
				125					130					135	
Ser	Ser	Asn	Lys	Tyr	His	Ser	Arg	Ile	His	Asp	Glu	Asn	Tyr	Ala	
				140					145					150	
Ile	Thr	Thr	Asn	Asn	Lys	Leu	Ser	Ile	Ala	Ser	Ile	Met	Val	Asn	
				155					160					165	
Thr	Cys	Tyr	Asp	Ile	Ser	Ile	Asn	Asn	Thr	Ser	Ile	Val	Pro	Tyr	
				170					175					180	
Leu	Cys	Thr	Gly	Ile	Gly	Glu	Asp	Leu	Val	Gly	Leu	Phe	Asn	Thr	
				185					190					195	
Ile	His	Phe	Lys	Leu	Ala	Tyr	Gln	Gly	Lys	Val	Gly	Met	Ser	Tyr	
				200					205					210	
Leu	Ile	Asn	Asn	Asn	Ile	Leu	Leu	Phe	Ser	Asp	Ile	Tyr	Tyr	His	
				215					220					225	
Lys	Val	Met	Gly	Asn	Arg	Phe	Lys	Asn	Leu	Tyr	Met	Gln	Tyr	Val	
				230					235					240	
Ala	Asp	Pro	Asn	Ile	Ser	Glu	Glu	Thr	Ile	Pro	Ile	Leu	Ala	Lys	
				245					250					255	
Leu	Asp	Ile	Gly	Tyr	Phe	Gly	Ser	Glu	Ile	Gly	Ile	Arg	Phe	Met	
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Phe Asn

<210> 5

<211> 295

<212> PRT

<213> *Ehrlichia chaffeensis*

<220>

<223> P28-5 Outer Membrane Protein of  
*Ehrlichia chaffeensis*

<400> 5

Met	Thr	Lys	Lys	Phe	Asn	Phe	Val	Asn	Val	Ile	Leu	Thr	Phe	Leu	
				5					10					15	
Leu	Phe	Leu	Phe	Pro	Leu	Lys	Ser	Phe	Thr	Thr	Tyr	Ala	Asn	Asn	
				20					25					30	
Asn	Thr	Ile	Thr	Gln	Lys	Val	Gly	Leu	Tyr	Ile	Ser	Gly	Gln	Tyr	
				35					40					45	
Lys	Pro	Ser	Ile	Pro	His	Phe	Lys	Asn	Phe	Ser	Val	Glu	Glu	Asn	
				50					55					60	
Asp	Lys	Val	Val	Asp	Leu	Ile	Gly	Leu	Thr	Thr	Asp	Val	Thr	Tyr	
				65					70					75	
Ile	Thr	Glu	His	Ile	Leu	Arg	Asp	Asn	Thr	Lys	Phe	Asn	Thr	His	
				80					85					90	
Tyr	Ile	Ala	Lys	Phe	Lys	Asn	Asn	Phe	Ile	Asn	Phe	Ser	Ser	Ala	
				95					100					105	
Ile	Gly	Tyr	Tyr	Ser	Gly	Gln	Gly	Pro	Arg	Leu	Glu	Ile	Glu	Ser	
				110					115					120	
Ser	Tyr	Gly	Asp	Phe	Asp	Val	Val	Asn	Tyr	Lys	Asn	Tyr	Ala	Val	
				125					130					135	



Gln	Asp	Val	Asn	Arg	Tyr	Phe	Ala	Leu	Val	Arg	Glu	Lys	Asn	Gly
				140					145					150
Ser	Asn	Phe	Ser	Pro	Lys	Pro	His	Glu	Thr	Ser	Gln	Pro	Ser	Asp
				155					160					165
Ser	Asn	Pro	Lys	Lys	Ser	Phe	Tyr	Thr	Leu	Met	Lys	Asn	Asn	Gly
				170					175					180
Val	Phe	Val	Ala	Ser	Val	Ile	Ile	Asn	Gly	Cys	Tyr	Asp	Phe	Ser
				185					190					195
Phe	Asn	Asn	Thr	Thr	Ile	Ser	Pro	Tyr	Val	Cys	Ile	Gly	Val	Gly
				200					205					210
Gly	Asp	Phe	Ile	Glu	Phe	Phe	Glu	Val	Met	His	Ile	Lys	Phe	Ala
				215					220					225
Cys	Gln	Ser	Lys	Val	Gly	Ile	Ser	Tyr	Pro	Ile	Ser	Pro	Ser	Ile
				230					235					240
Thr	Ile	Phe	Ala	Asp	Ala	His	Tyr	His	Lys	Val	Ile	Asn	Asn	Lys
				245					250					255
Phe	Asn	Asn	Leu	His	Val	Lys	Tyr	Ser	Tyr	Glu	Leu	Lys	Asn	Ser
				260					265					270
Pro	Thr	Ile	Thr	Ser	Ala	Thr	Ala	Lys	Leu	Asn	Ile	Glu	Tyr	Phe
				275					280					285
Gly	Gly	Glu	Val	Gly	Met	Arg	Phe	Ile	Phe					
				290					295					

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<212> PRT

<213> *Ehrlichia chaffeensis*

<220>

<223> P28-6 Outer Membrane Protein of

*Ehrlichia chaffeensis*

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<400>      6
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              5              10              15

Leu Leu Ser Phe Leu Ser Ile Glu Ser Phe Ser Ala Ile Asn His
              20              25              30

Asn His Thr Gly Asn Asn Thr Ser Gly Ile Tyr Ile Thr Gly Gln
              35              40              45

Tyr Arg Pro Gly Val Ser His Phe Ser Asn Phe Ser Val Lys Glu
              50              55              60

Thr Asn Val Asp Thr Ile Gln Leu Val Gly Tyr Lys Lys Ser Ala
              65              70              75

Ser Ser Ile Asp Pro Asn Thr Tyr Ser Asn Phe Gln Gly Pro Tyr
              80              85              90

Thr Val Thr Phe Gln Asp Asn Ala Ala Ser Phe Ser Gly Ala Ile
              95              100             105

Gly Tyr Ser Tyr Pro Glu Ser Leu Arg Leu Glu Leu Glu Gly Ser
              110             115             120

Tyr Glu Lys Phe Asp Val Lys Asp Pro Lys Asp Tyr Ser Ala Lys
              125             130             135

Asp Ala Phe Arg Phe Phe Ala Leu Ala Arg Asn Thr Ser Thr Thr
              140             145             150

Val Pro Asp Ala Gln Lys Tyr Thr Val Met Lys Asn Asn Gly Leu
              155             160             165

Ser Val Ala Ser Ile Met Ile Asn Gly Cys Tyr Asp Leu Ser Phe
              170             175             180

Asn Asn Leu Val Val Ser Pro Tyr Ile Cys Ala Gly Ile Gly Glu
              185             190             195

Asp Phe Ile Glu Phe Phe Asp Thr Leu His Ile Lys Leu Ala Tyr
              200             205             210

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Gln Gly Lys Leu Gly Ile Ser Tyr Tyr Phe Phe Pro Lys Ile Asn  
215 220 225

Val Phe Ala Gly Gly Tyr Tyr His Arg Val Ile Gly Asn Lys Phe  
230 235 240

Lys Asn Leu Asn Val Asn His Val Val Thr Pro Asp Glu Phe Pro  
245 250 255

Lys Ala Thr Ser Ala Val Ala Thr Leu Asn Val Ala Tyr Phe Gly  
260 265 270

Gly Glu Ala Gly Val Lys Phe Thr Phe  
275

<210> 7  
<211> 283  
<212> PRT  
<213> *Ehrlichia chaffeensis*

<220>  
<223> P28-7 Outer Membrane Protein of  
*Ehrlichia chaffeensis*

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Met Ser Ala Lys Lys Lys Leu Phe Ile Ile Gly Ser Val Leu Val  
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Cys Leu Val Ser Tyr Leu Pro Thr Lys Ser Leu Ser Asn Leu Asn  
20 25 30

Asn Ile Asn Asn Asn Thr Lys Cys Thr Gly Leu Tyr Val Ser Gly  
35 40 45

Gln Tyr Lys Pro Thr Val Ser His Phe Ser Asn Phe Ser Leu Lys  
50 55 60

Glu Thr Tyr Thr Asp Thr Lys Glu Leu Leu Gly Leu Ala Lys Asp  
65 70 75

Ile	Lys	Ser	Ile	Thr	Asp	Ile	Thr	Thr	Asn	Lys	Lys	Phe	Asn	Ile	
				80					85					90	
Pro	Tyr	Asn	Thr	Lys	Phe	Gln	Asp	Asn	Ala	Val	Ser	Phe	Ser	Ala	
				95					100					105	
Ala	Val	Gly	Tyr	Ile	Ser	Gln	Asp	Ser	Pro	Arg	Val	Glu	Val	Glu	
				110					115					120	
Trp	Ser	Tyr	Glu	Glu	Phe	Asp	Val	Lys	Asn	Pro	Gly	Asn	Tyr	Val	
				125					130					135	
Val	Ser	Glu	Ala	Phe	Arg	Tyr	Ile	Ala	Leu	Ala	Arg	Gly	Ile	Asp	
				140					145					150	
Asn	Leu	Gln	Lys	Tyr	Pro	Glu	Thr	Asn	Lys	Tyr	Val	Val	Ile	Lys	
				155					160					165	
Asn	Asn	Gly	Leu	Ser	Val	Ala	Ser	Ile	Ile	Ile	Asn	Gly	Cys	Tyr	
				170					175					180	
Asp	Phe	Ser	Leu	Asn	Asn	Leu	Lys	Val	Ser	Pro	Tyr	Ile	Cys	Val	
				185					190					195	
Gly	Phe	Gly	Gly	Asp	Ile	Ile	Glu	Phe	Phe	Ser	Ala	Val	Ser	Phe	
200					205					210					
Lys	Phe	Ala	Tyr	Gln	Gly	Lys	Val	Gly	Ile	Ser	Tyr	Pro	Leu	Phe	
				215					220					225	
Ser	Asn	Met	Ile	Ile	Phe	Ala	Asp	Gly	Tyr	Tyr	His	Lys	Val	Ile	
				230					235					240	
Gly	Asn	Lys	Phe	Asn	Asn	Leu	Asn	Val	Gln	His	Val	Val	Ser	Leu	
				245					250					255	
Asn	Ser	His	Pro	Lys	Ser	Thr	Phe	Ala	Val	Ala	Thr	Leu	Asn	Val	
				260					265					270	
Glu	Tyr	Phe	Gly	Ser	Glu	Phe	Gly	Leu	Lys	Phe	Ile	Phe			
				275					280						

<210> 8  
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 <213> *Ehrlichia chaffeensis*

<220>  
 <223> P28-8 Outer Membrane Protein of  
*Ehrlichia chaffeensis*

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 Met Leu Leu Pro Asn Ile Ser Phe Pro Glu Thr Ile Asn Asn Asn  
                   20                  25                  30  
 Thr Asp Lys Leu Ser Gly Leu Tyr Ile Ser Gly Gln Tyr Lys Pro  
                   35                  40                  45  
 Gly Ile Ser His Phe Ser Lys Phe Ser Val Lys Glu Ile Tyr Asn  
                   50                  55                  60  
 Asp Asn Ile Gln Leu Ile Gly Leu Arg His Asn Ala Ile Ser Thr  
                   65                  70                  75  
 Ser Thr Leu Asn Ile Asn Thr Asp Phe Asn Ile Pro Tyr Lys Val  
                   80                  85                  90  
 Thr Phe Gln Asn Asn Ile Thr Ser Phe Ser Gly Ala Ile Gly Tyr  
                   95                  100                  105  
 Ser Asp Pro Thr Gly Ala Arg Phe Glu Leu Glu Gly Ser Tyr Glu  
                   110                  115                  120  
 Glu Phe Asp Val Thr Asp Pro Gly Asp Cys Leu Ile Lys Asp Thr  
                   125                  130                  135  
 Tyr Arg Tyr Phe Ala Leu Ala Arg Asn Pro Ser Gly Ser Ser Pro  
                   140                  145                  150

Thr Ser Asn Asn Tyr Thr Val Met Arg Asn Asp Gly Val Ser Ile  
155 160 165

Thr Ser Val Ile Phe Asn Gly Cys Tyr Asp Ile Phe Leu Lys Asp  
170 175 180

Leu Glu Val Ser Pro Tyr Val Cys Val Gly Val Gly Gly Asp Phe  
185 190 195

Ile Glu Phe Phe Asp Ala Leu His Ile Lys Leu Ala Tyr Gln Gly  
200 205 210

Lys Leu Gly Ile Asn Tyr His Leu Ser Thr Gln Ala Ser Val Phe  
215 220 225

Ile Asp Gly Tyr Tyr His Lys Val Ile Gly Asn Gln Phe Asn Asn  
230 235 240

Leu Asn Val Gln His Val Ala Ser Thr Asp Phe Gly Pro Val Tyr  
245 250 255

Ala Val Ala Thr Leu Asn Ile Gly Tyr Phe Gly Gly Glu Ile Gly  
260 265 270

Ile Arg Leu Thr Phe  
275

<210> 9

<211> 285

<212> PRT

<213> *Ehrlichia chaffeensis*

<220>

<223> P28-9 Outer Membrane Protein of  
*Ehrlichia chaffeensis*

<400> 9

Met Asn Asn Arg Lys Ser Phe Phe Ile Ile Gly Ala Ser Leu Leu  
5 10 15

Ala	Ser	Leu	Leu	Phe	Thr	Ser	Glu	Ala	Ser	Ser	Thr	Gly	Asn	Val	20	25	30
Ser	Asn	His	Thr	Tyr	Phe	Lys	Pro	Arg	Leu	Tyr	Ile	Ser	Gly	Gln	35	40	45
Tyr	Arg	Pro	Gly	Val	Ser	His	Phe	Ser	Lys	Phe	Ser	Val	Lys	Glu	50	55	60
Thr	Asn	Tyr	Asn	Thr	Thr	Gln	Leu	Val	Gly	Leu	Lys	Lys	Asp	Ile	65	70	75
Ser	Val	Ile	Gly	Asn	Ser	Asn	Ile	Thr	Thr	Tyr	Thr	Asn	Phe	Asn	80	85	90
Phe	Pro	Tyr	Ile	Ala	Glu	Phe	Gln	Asp	Asn	Ala	Ile	Ser	Phe	Ser	95	100	105
Gly	Ala	Ile	Gly	Tyr	Leu	Tyr	Ser	Glu	Asn	Phe	Arg	Ile	Glu	Val	110	115	120
Glu	Ala	Ser	Tyr	Glu	Glu	Phe	Asp	Val	Lys	Asn	Pro	Glu	Gly	Ser	125	130	135
Ala	Thr	Asp	Ala	Tyr	Arg	Tyr	Phe	Ala	Leu	Ala	Arg	Ala	Met	Asp	140	145	150
Gly	Thr	Asn	Lys	Ser	Ser	Pro	Asp	Asp	Thr	Arg	Lys	Phe	Thr	Val	155	160	165
Met	Arg	Asn	Asp	Gly	Leu	Ser	Ile	Ser	Ser	Val	Met	Ile	Asn	Gly	170	175	180
Cys	Tyr	Asn	Phe	Thr	Leu	Asp	Asp	Ile	Pro	Val	Val	Pro	Tyr	Val	185	190	195
Cys	Ala	Gly	Ile	Gly	Gly	Asp	Phe	Ile	Glu	Phe	Phe	Asn	Asp	Leu	200	205	210
His	Val	Lys	Phe	Ala	His	Gln	Gly	Lys	Val	Gly	Ile	Ser	Tyr	Ser	215	220	225
Ile	Ser	Pro	Glu	Val	Ser	Leu	Phe	Leu	Asn	Gly	Tyr	Tyr	His	Lys	230	235	240

Val Thr Gly Asn Arg Phe Lys Asn Leu His Val Gln His Val Ser  
245 250 255

Asp Leu Ser Asp Ala Pro Lys Phe Thr Ser Ala Val Ala Thr Leu  
260 265 270

Asn Val Gly Tyr Phe Gly Gly Glu Ile Gly Val Arg Phe Ile Phe  
275 280 285

<210> 10

<211> 291

<212> PRT

<213> *Ehrlichia chaffeensis*

<220>

<223> P28-10 Outer Membrane Protein of  
*Ehrlichia chaffeensis*

<400> 10

Met Asn Lys Lys Asn Lys Phe Ile Ile Ala Thr Ala Leu Val Tyr  
5 10 15

Leu Leu Ser Leu Pro Ser Val Ser Phe Ser Glu Val Thr Asn Ser  
20 25 30

Ser Ile Lys Lys His Ser Gly Leu Tyr Ile Ser Gly Gln Tyr Lys  
35 40 45

Pro Ser Val Ser Val Phe Ser Ser Phe Ser Ile Lys Glu Thr Asn  
50 55 60

Thr Ile Thr Lys Ile Leu Ile Ala Leu Lys Lys Asp Ile Asn Ser  
65 70 75

Leu Glu Val Asn Ala Asp Ala Ser Gln Gly Ile Ser His Pro Gly  
80 85 90

Asn Phe Thr Ile Pro Tyr Ile Ala Ala Phe Glu Asp Asn Ala Phe  
95 100 105



Asn	Phe	Asn	Gly	Ala	Ile	Gly	Tyr	Ile	Thr	Glu	Gly	Leu	Arg	Ile	110	115	120
Glu	Ile	Glu	Gly	Ser	Tyr	Glu	Glu	Phe	Asp	Ala	Lys	Asn	Pro	Gly	125	130	135
Gly	Tyr	Gly	Leu	Asn	Asp	Ala	Phe	Arg	Tyr	Phe	Ala	Leu	Ala	Arg	140	145	150
Asp	Met	Glu	Ser	Asn	Lys	Phe	Gln	Pro	Lys	Ala	Gln	Ser	Ser	Gln	155	160	165
Lys	Val	Phe	His	Thr	Val	Met	Lys	Ser	Asp	Gly	Leu	Ser	Ile	Ile	170	175	180
Ser	Ile	Met	Gly	Asn	Gly	Trp	Tyr	Asp	Phe	Ser	Ser	Asp	Asn	Leu	185	190	195
Leu	Val	Ser	Pro	Tyr	Ile	Cys	Gly	Gly	Ile	Gly	Val	Asp	Ala	Ile	200	205	210
Glu	Phe	Phe	Asp	Ala	Leu	His	Ile	Lys	Leu	Ala	Cys	Pro	Ser	Lys	215	220	225
Leu	Gly	Ile	Thr	Tyr	Gln	Leu	Ser	Tyr	Asn	Ile	Ser	Leu	Phe	Ala	230	235	240
Val	Gly	Phe	Tyr	His	Gln	Val	Ile	Gly	Asn	Gln	Phe	Arg	Asn	Leu	245	250	255
Asn	Val	Gln	His	Val	Ala	Glu	Leu	Asn	Asp	Ala	Pro	Lys	Val	Thr	260	265	270
Ser	Ala	Val	Ala	Thr	Leu	Asn	Val	Gly	Tyr	Phe	Gly	Ala	Glu	Val	275	280	285
Gly	Val	Arg	Phe	Ile	Phe										290		

<210> 11  
 <211> 298  
 <212> PRT

<213>      *Ehrlichia chaffeensis*

<220>

<223>      P28-11 Outer Membrane Protein of  
            *Ehrlichia chaffeensis*

<400>      11

Met	Asn	His	Lys	Ser	Met	Leu	Phe	Thr	Ile	Gly	Thr	Ala	Leu	Ile	
				5					10					15	
Ser	Leu	Leu	Ser	Leu	Pro	Asn	Val	Ser	Phe	Ser	Gly	Ile	Ile	Asn	
				20					25					30	
Asn	Asn	Ala	Asn	Asn	Leu	Gly	Ile	Tyr	Ile	Ser	Gly	Gln	Tyr	Lys	
				35					40					45	
Pro	Ser	Val	Ser	Val	Phe	Ser	Asn	Phe	Ser	Val	Lys	Glu	Thr	Asn	
				50					55					60	
Phe	Thr	Thr	Gln	Gln	Leu	Val	Ala	Leu	Lys	Lys	Asp	Ile	Asp	Ser	
				65					70					75	
Val	Asp	Ile	Ser	Thr	Asn	Ala	Asp	Ser	Gly	Ile	Asn	Asn	Pro	Gln	
				80					85					90	
Asn	Phe	Thr	Ile	Pro	Tyr	Ile	Pro	Lys	Phe	Gln	Asp	Asn	Ala	Ala	
				95					100					105	
Ser	Phe	Ser	Gly	Ala	Leu	Gly	Phe	Phe	Tyr	Ala	Arg	Gly	Leu	Arg	
				110					115					120	
Leu	Glu	Met	Glu	Gly	Ser	Tyr	Glu	Glu	Phe	Asp	Val	Lys	Asn	Pro	
				125					130					135	
Gly	Gly	Tyr	Thr	Lys	Val	Lys	Asp	Ala	Tyr	Arg	Tyr	Phe	Ala	Leu	
				140					145					150	
Ala	Arg	Glu	Met	Gln	Ser	Gly	Gln	Thr	Cys	Pro	Lys	His	Lys	Glu	
				155					160					165	
Thr	Ser	Gly	Ile	Gln	Pro	His	Gly	Ile	Tyr	His	Thr	Val	Met	Arg	
				170					175					180	

Asn Asp Gly Val Ser Ile Ser Ser Val Ile Ile Asn Gly Cys Tyr  
 185 190 195

Asn Phe Thr Leu Ser Asn Leu Pro Ile Ser Pro Tyr Met Cys Val  
 200 205 210

Gly Met Gly Ile Asp Ala Ile Gln Phe Phe Asp Ser Leu His Ile  
 215 220 225

Lys Phe Ala His Gln Ser Lys Leu Gly Ile Thr Tyr Pro Leu Ser  
 230 235 240

Ser Asn Val His Leu Phe Ala Asp Ser Tyr Tyr His Lys Val Ile  
 245 250 255

Gly Asn Lys Phe Lys Asn Leu Arg Val Gln His Val Tyr Glu Leu  
 260 265 270

Gln Gln Val Pro Lys Val Thr Ser Ala Val Ala Thr Leu Asp Ile  
 275 280 285

Gly Tyr Phe Gly Gly Glu Val Gly Val Arg Phe Ile Leu  
 290 295

<210> 12

<211> 300

<212> PRT

<213> *Ehrlichia chaffeensis*

<220>

<223> P28-12 Outer Membrane Protein of  
*Ehrlichia chaffeensis*

<400> 12

Met Lys Lys Lys Asn Gln Phe Ile Thr Ile Ser Thr Ile Leu Val  
 5 10 15

Cys Leu Leu Ser Leu Ser Asn Ala Ser Leu Ser Asn Thr Thr Asn  
 20 25 30

Ser	Ser	Thr	Lys	Lys	Gln	Phe	Gly	Leu	Tyr	Val	Ser	Gly	Gln	Tyr	35	40	45
Lys	Pro	Ser	Val	Ser	Ile	Phe	Ser	Asn	Phe	Ser	Val	Lys	Glu	Thr	50	55	60
Asn	Phe	Pro	Thr	Lys	Tyr	Leu	Ala	Ala	Leu	Lys	Lys	Asp	Ile	Asn	65	70	75
Ser	Val	Glu	Phe	Asp	Asp	Ser	Val	Thr	Ala	Gly	Ile	Ser	Tyr	Pro	80	85	90
Leu	Asn	Phe	Ser	Thr	Pro	Tyr	Ile	Ala	Val	Phe	Gln	Asp	Asn	Ile	95	100	105
Ser	Asn	Phe	Asn	Gly	Ala	Ile	Gly	Tyr	Thr	Phe	Val	Glu	Gly	Pro	110	115	120
Arg	Ile	Glu	Ile	Glu	Gly	Ser	Tyr	Glu	Glu	Phe	Asp	Val	Lys	Asp	125	130	135
Pro	Gly	Arg	Tyr	Thr	Glu	Ile	Gln	Asp	Ala	Tyr	Arg	Tyr	Phe	Ala	140	145	150
Leu	Ala	Arg	Asp	Ile	Asp	Ser	Ile	Pro	Thr	Ser	Pro	Lys	Asn	Arg	155	160	165
Thr	Ser	His	Asp	Gly	Asn	Ser	Ser	Tyr	Lys	Val	Tyr	His	Thr	Val	170	175	180
Met	Lys	Asn	Glu	Gly	Leu	Ser	Ile	Ile	Ser	Ile	Met	Val	Asn	Gly	185	190	195
Cys	Tyr	Asp	Phe	Ser	Ser	Asp	Asn	Leu	Ser	Ile	Leu	Pro	Tyr	Val	200	205	210
Cys	Gly	Gly	Ile	Gly	Val	Asn	Ala	Ile	Glu	Phe	Phe	Asp	Ala	Leu	215	220	225
His	Val	Lys	Phe	Ala	Cys	Gln	Gly	Lys	Leu	Gly	Ile	Thr	Tyr	Pro	230	235	240
Leu	Ser	Ser	Asn	Val	Ser	Leu	Phe	Ala	Gly	Gly	Tyr	Tyr	His	Gln	245	250	255

Val Met Gly Asn Gln Phe Lys Asn Leu Asn Val Gln His Val Ala  
260 265 270

Glu Leu Asn Asp Ala Pro Lys Val Thr Ser Ala Val Ala Thr Leu  
275 280 285

Asp Ile Gly Tyr Phe Gly Gly Glu Ile Gly Ala Arg Leu Ile Phe  
290 295 300

<210> 13

<211> 293

<212> PRT

<213> *Ehrlichia chaffeensis*

<220>

<223> P28-13 Outer Membrane Protein of  
*Ehrlichia chaffeensis*

<400> 13

Met Asn Lys Lys Asn Lys Phe Phe Thr Ile Ser Thr Ala Met Val  
5 10 15

Cys Leu Leu Leu Leu Pro Gly Ile Ser Phe Ser Glu Thr Ile Asn  
20 25 30

Asn Ser Ala Lys Lys Gln Pro Gly Leu Tyr Ile Ser Gly Gln Tyr  
35 40 45

Lys Pro Ser Val Ser Val Phe Ser Asn Phe Ser Val Lys Glu Thr  
50 55 60

Asn Val Pro Thr Lys Gln Leu Ile Ala Leu Lys Lys Asp Ile Asn  
65 70 75

Ser Val Ala Val Gly Ser Asn Ala Thr Thr Gly Ile Ser Asn Pro  
80 85 90

Gly	Asn	Phe	Thr	Ile	Pro	Tyr	Thr	Ala	Glu	Phe	Gln	Asp	Asn	Val	
				95					100					105	
Ala	Asn	Phe	Asn	Gly	Ala	Val	Gly	Tyr	Ser	Phe	Pro	Asp	Ser	Leu	
				110					115					120	
Arg	Ile	Glu	Ile	Glu	Gly	Phe	His	Glu	Lys	Phe	Asp	Val	Lys	Asn	
				125					130					135	
Pro	Gly	Gly	Tyr	Thr	Gln	Val	Lys	Asp	Ala	Tyr	Arg	Tyr	Phe	Ala	
				140					145					150	
Leu	Ala	Arg	Asp	Leu	Lys	Asp	Gly	Phe	Phe	Glu	Pro	Lys	Ala	Glu	
				155					160					165	
Asp	Thr	Gly	Val	Tyr	His	Thr	Val	Met	Lys	Asn	Asp	Gly	Leu	Ser	
				170					175					180	
Ile	Leu	Ser	Thr	Met	Val	Asn	Val	Cys	Tyr	Asp	Phe	Ser	Val	Asp	
				185					190					195	
Glu	Leu	Pro	Val	Leu	Pro	Tyr	Ile	Cys	Ala	Gly	Met	Gly	Ile	Asn	
				200					205					210	
Ala	Ile	Glu	Phe	Phe	Asp	Ala	Leu	His	Val	Lys	Phe	Ala	Tyr	Gln	
				215					220					225	
Gly	Lys	Leu	Gly	Ile	Ser	Tyr	Gln	Leu	Phe	Thr	Lys	Val	Asn	Leu	
				230					235					240	
Phe	Leu	Asp	Gly	Tyr	Tyr	His	Gln	Val	Ile	Gly	Asn	Gln	Phe	Lys	
				245					250					255	
Asn	Leu	Asn	Val	Asn	His	Val	Tyr	Thr	Leu	Lys	Glu	Ser	Pro	Lys	
				260					265					270	
Val	Thr	Ser	Ala	Val	Ala	Thr	Leu	Asp	Ile	Ala	Tyr	Phe	Gly	Gly	
				275					280					285	
Glu	Val	Gly	Ile	Arg	Phe	Thr	Phe								
				290											

分子式	分子量	熔点/°C	沸点/°C	密度/g·cm <sup>-3</sup>	折光率	溶解性
CH <sub>3</sub> COOH	60	16.6	118.1	1.049	1.371	与水混溶
CH <sub>3</sub> CH <sub>2</sub> COOH	74	-83.6	118.1	0.989	1.386	与水混溶
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> COOH	88	-48.6	141.1	0.960	1.399	与水混溶
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> COOH	102	-34.5	163.5	0.938	1.410	与水混溶
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> COOH	116	-19.4	186.0	0.916	1.421	与水混溶
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> COOH	130	-4.4	208.5	0.894	1.432	与水混溶
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> COOH	144	10.6	231.0	0.872	1.443	与水混溶
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> COOH	158	25.6	253.5	0.850	1.454	与水混溶
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> COOH	172	40.6	276.0	0.828	1.465	与水混溶
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> COOH	186	55.6	298.5	0.806	1.476	与水混溶
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> COOH	200	70.6	321.0	0.784	1.487	与水混溶
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> COOH	214	85.6	343.5	0.762	1.498	与水混溶
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> COOH	228	100.6	366.0	0.740	1.509	与水混溶
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> COOH	242	115.6	388.5	0.718	1.520	与水混溶
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> COOH	256	130.6	411.0	0.696	1.531	与水混溶
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> COOH	270	145.6	433.5	0.674	1.542	与水混溶
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> COOH	284	160.6	456.0	0.652	1.553	与水混溶
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> COOH	298	175.6	478.5	0.630	1.564	与水混溶
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> COOH	312	190.6	501.0	0.608	1.575	与水混溶
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> COOH	326	205.6	523.5	0.586	1.586	与水混溶
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> COOH	340	220.6	546.0	0.564	1.597	与水混溶
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> COOH	354	235.6	568.5	0.542	1.608	与水混溶
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> COOH	368	250.6	591.0	0.520	1.619	与水混溶
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub>						

<223> P28-14 Outer Membrane Protein of  
*Ehrlichia chaffeensis*

SEQ 23

Ser Arg Glu Asp Ala Ile Ala Asp Lys Lys Tyr Val Val Leu Lys  
155 160 165

Asn Glu Gly Ile Thr Phe Met Ser Leu Met Val Asn Thr Cys Tyr  
170 175 180

Asp Ile Thr Ala Glu Gly Val Pro Phe Ile Pro Tyr Ala Cys Ala  
185 190 195

Gly Val Gly Ala Asp Leu Ile Asn Val Phe Lys Asp Phe Asn Leu  
200 205 210

Lys Phe Ser Tyr Gln Gly Lys Ile Gly Ile Ser Tyr Pro Ile Thr  
215 220 225

Pro Glu Val Ser Ala Phe Ile Gly Gly Tyr Tyr His Gly Val Ile  
230 235 240

Gly Asn Asn Phe Asn Lys Ile Pro Val Ile Thr Pro Val Val Leu  
245 250 255

Glu Gly Ala Pro Gln Thr Thr Ser Ala Leu Val Thr Ile Asp Thr  
260 265 270

Gly Tyr Phe Gly Gly Glu Val Gly Val Arg Phe Thr Phe  
275 280

<210> 15

<211> 280

<212> PRT

<213> *Ehrlichia chaffeensis*

<220>

<223> P28-15 Outer Membrane Protein of  
*Ehrlichia chaffeensis*

<400> 15

Met Asn Cys Lys Lys Phe Phe Ile Thr Thr Ala Leu Ala Leu Pro  
5 10 15



Met	Ser	Phe	Leu	Pro	Gly	Ile	Leu	Leu	Ser	Glu	Pro	Val	Gln	Asp	20	25	30
Asp	Ser	Val	Ser	Gly	Asn	Phe	Tyr	Ile	Ser	Gly	Lys	Tyr	Met	Pro	35	40	45
Ser	Ala	Ser	His	Phe	Gly	Val	Phe	Ser	Ala	Lys	Glu	Glu	Lys	Asn	50	55	60
Pro	Thr	Val	Ala	Leu	Tyr	Gly	Leu	Lys	Gln	Asp	Trp	Asn	Gly	Val	65	70	75
Ser	Ala	Ser	Ser	His	Ala	Asp	Ala	Asp	Phe	Asn	Asn	Lys	Gly	Tyr	80	85	90
Ser	Phe	Lys	Tyr	Glu	Asn	Asn	Pro	Phe	Leu	Gly	Phe	Ala	Gly	Ala	95	100	105
Ile	Gly	Tyr	Ser	Met	Gly	Gly	Pro	Arg	Ile	Glu	Phe	Glu	Val	Ser	110	115	120
Tyr	Glu	Thr	Phe	Asp	Val	Lys	Asn	Gln	Gly	Gly	Asn	Tyr	Lys	Asn	125	130	135
Asp	Ala	His	Arg	Tyr	Cys	Ala	Leu	Asp	Arg	Lys	Ala	Ser	Ser	Thr	140	145	150
Asn	Ala	Thr	Ala	Ser	His	Tyr	Val	Leu	Leu	Lys	Asn	Glu	Gly	Leu	155	160	165
Leu	Asp	Ile	Ser	Leu	Met	Leu	Asn	Ala	Cys	Tyr	Asp	Val	Val	Ser	170	175	180
Glu	Gly	Ile	Pro	Phe	Ser	Pro	Tyr	Ile	Cys	Ala	Gly	Val	Gly	Thr	185	190	195
Asp	Leu	Ile	Ser	Met	Phe	Glu	Ala	Ile	Asn	Pro	Lys	Ile	Ser	Tyr	200	205	210
Gln	Gly	Lys	Leu	Gly	Leu	Ser	Tyr	Ser	Ile	Asn	Pro	Glu	Ala	Ser	215	220	225
Val	Phe	Val	Gly	Gly	His	Phe	His	Lys	Val	Ala	Gly	Asn	Glu	Phe	230	235	240

Arg Asp Ile Ser Thr Leu Lys Ala Phe Ala Thr Pro Ser Ser Ala  
 245 250 255

Ala Thr Pro Asp Leu Ala Thr Val Thr Leu Ser Val Cys His Phe  
 260 265 270

Gly Val Glu Leu Gly Gly Arg Phe Asn Phe  
 275 280

<210> 16

<211> 286

<212> PRT

<213> *Ehrlichia chaffeensis*

<220>

<223> P28-16 Outer Membrane Protein of  
*Ehrlichia chaffeensis*

<400> 16

Met Asn Cys Glu Lys Phe Phe Ile Thr Thr Ala Leu Thr Leu Leu  
 5 10 15

Met Ser Phe Leu Pro Gly Ile Ser Leu Ser Asp Pro Val Gln Asp  
 20 25 30

Asp Asn Ile Ser Gly Asn Phe Tyr Ile Ser Gly Lys Tyr Met Pro  
 35 40 45

Ser Ala Ser His Phe Gly Val Phe Ser Ala Lys Glu Glu Arg Asn  
 50 55 60

Thr Thr Val Gly Val Phe Gly Ile Glu Gln Asp Trp Asp Arg Cys  
 65 70 75

Val Ile Ser Arg Thr Thr Leu Ser Asp Ile Phe Thr Val Pro Asn  
 80 85 90

Tyr Ser Phe Lys Tyr Glu Asn Asn Leu Phe Ser Gly Phe Ala Gly  
 95 100 105



<213>      *Ehrlichia chaffeensis*

<220>

<223>      P28-17 Outer Membrane Protein of  
            *Ehrlichia chaffeensis*

<400>      17

Met	Asn	Cys	Lys	Lys	Phe	Phe	Ile	Thr	Thr	Ala	Leu	Val	Ser	Leu	
				5					10					15	
Met	Ser	Phe	Leu	Pro	Gly	Ile	Ser	Phe	Ser	Asp	Pro	Val	Gln	Gly	
				20					25					30	
Asp	Asn	Ile	Ser	Gly	Asn	Phe	Tyr	Val	Ser	Gly	Lys	Tyr	Met	Pro	
				35					40					45	
Ser	Ala	Ser	His	Phe	Gly	Met	Phe	Ser	Ala	Lys	Glu	Glu	Lys	Asn	
				50					55					60	
Pro	Thr	Val	Ala	Leu	Tyr	Gly	Leu	Lys	Gln	Asp	Trp	Glu	Gly	Ile	
				65					70					75	
Ser	Ser	Ser	Ser	His	Asn	Asp	Asn	His	Phe	Asn	Asn	Lys	Gly	Tyr	
				80					85					90	
Ser	Phe	Lys	Tyr	Glu	Asn	Asn	Pro	Phe	Leu	Gly	Phe	Ala	Gly	Ala	
				95					100					105	
Ile	Gly	Tyr	Ser	Met	Gly	Gly	Pro	Arg	Val	Glu	Phe	Glu	Val	Ser	
				110					115					120	
Tyr	Glu	Thr	Phe	Asp	Val	Lys	Asn	Gln	Gly	Asn	Asn	Tyr	Lys	Asn	
				125					130					135	
Asp	Ala	His	Arg	Tyr	Cys	Ala	Leu	Gly	Gln	Gln	Asp	Asn	Ser	Gly	
				140					145					150	
Ile	Pro	Lys	Thr	Ser	Lys	Tyr	Val	Leu	Leu	Lys	Ser	Glu	Gly	Leu	
				155					160					165	
Leu	Asp	Ile	Ser	Phe	Met	Leu	Asn	Ala	Cys	Tyr	Asp	Ile	Ile	Asn	
				170					175					180	

Glu Ser Ile Pro Leu Ser Pro Tyr Ile Cys Ala Gly Val Gly Thr  
185 190 195

Asp Leu Ile Ser Met Phe Glu Ala Thr Asn Pro Lys Ile Ser Tyr  
200 205 210

Gln Gly Lys Leu Gly Leu Ser Tyr Ser Ile Asn Pro Glu Ala Ser  
215 220 225

Val Phe Ile Gly Gly His Phe His Lys Val Ile Gly Asn Glu Phe  
230 235 240

Arg Asp Ile Pro Thr Leu Lys Ala Phe Val Thr Ser Ser Ala Thr  
245 250 255

Pro Asp Leu Ala Ile Val Thr Leu Ser Val Cys His Phe Gly Ile  
260 265 270

Glu Leu Gly Gly Arg Phe Asn Phe  
275

<210> 18

<211> 280

<212> PRT

<213> *Ehrlichia chaffeensis*

<220>

<223> P28-18 Outer Membrane Protein of  
*Ehrlichia chaffeensis*

<400> 18

Met Asn Cys Lys Lys Phe Phe Ile Thr Thr Thr Leu Val Ser Leu  
5 10 15

Met Ser Phe Leu Pro Gly Ile Ser Phe Ser Asp Ala Val Gln Asn  
20 25 30

Asp Asn Val Gly Gly Asn Phe Tyr Ile Ser Gly Lys Tyr Val Pro  
35 40 45

Ser	Val	Ser	His	Phe	Gly	Val	Phe	Ser	Ala	Lys	Gln	Glu	Arg	Asn	
				50					55					60	
Thr	Thr	Ile	Gly	Val	Phe	Gly	Leu	Lys	Gln	Asp	Trp	Asp	Gly	Ser	
				65					70					75	
Thr	Ile	Ser	Lys	Asn	Ser	Pro	Glu	Asn	Thr	Phe	Asn	Val	Pro	Asn	
				80					85					90	
Tyr	Ser	Phe	Lys	Tyr	Glu	Asn	Asn	Pro	Phe	Leu	Gly	Phe	Ala	Gly	
				95					100					105	
Ala	Val	Gly	Tyr	Leu	Met	Asn	Gly	Pro	Arg	Ile	Glu	Leu	Glu	Met	
				110					115					120	
Ser	Tyr	Glu	Thr	Phe	Asp	Val	Lys	Asn	Gln	Gly	Asn	Asn	Tyr	Lys	
				125					130					135	
Asn	Asp	Ala	His	Lys	Tyr	Tyr	Ala	Leu	Thr	His	Asn	Ser	Gly	Gly	
				140					145					150	
Lys	Leu	Ser	Asn	Ala	Gly	Asp	Lys	Phe	Val	Phe	Leu	Lys	Asn	Glu	
				155					160					165	
Gly	Leu	Leu	Asp	Ile	Ser	Leu	Met	Leu	Asn	Ala	Cys	Tyr	Asp	Val	
				170					175					180	
Ile	Ser	Glu	Gly	Ile	Pro	Phe	Ser	Pro	Tyr	Ile	Cys	Ala	Gly	Val	
				185					190					195	
Gly	Thr	Asp	Leu	Ile	Ser	Met	Phe	Glu	Ala	Ile	Asn	Pro	Lys	Ile	
				200					205					210	
Ser	Tyr	Gln	Gly	Lys	Leu	Gly	Leu	Ser	Tyr	Ser	Ile	Ser	Pro	Glu	
				215					220					225	
Ala	Ser	Val	Phe	Val	Gly	Gly	His	Phe	His	Lys	Val	Ile	Gly	Asn	
				230					235					240	
Glu	Phe	Arg	Asp	Ile	Pro	Ala	Met	Ile	Pro	Ser	Thr	Ser	Thr	Leu	
				245					250					255	
Thr	Gly	Asn	His	Phe	Thr	Ile	Val	Thr	Leu	Ser	Val	Cys	His	Phe	
				260					265					270	

Gly Val Glu Leu Gly Gly Arg Phe Asn Phe  
 275 280

<210> 19

<211> 281

<212> PRT

<213> *Ehrlichia chaffeensis*

<220>

<223> P28-19 Outer Membrane Protein of  
*Ehrlichia chaffeensis*

<400> 19

Met	Asn	Tyr	Lys	Lys	Val	Phe	Ile	Thr	Ser	Ala	Leu	Ile	Ser	Leu	5	10	15
Ile	Ser	Ser	Leu	Pro	Gly	Val	Ser	Phe	Ser	Asp	Pro	Ala	Gly	Ser	20	25	30
Gly	Ile	Asn	Gly	Asn	Phe	Tyr	Ile	Ser	Gly	Lys	Tyr	Met	Pro	Ser	35	40	45
Ala	Ser	His	Phe	Gly	Val	Phe	Ser	Ala	Lys	Glu	Glu	Arg	Asn	Thr	50	55	60
Thr	Val	Gly	Val	Phe	Gly	Leu	Lys	Gln	Asn	Trp	Asp	Gly	Ser	Ala	65	70	75
Ile	Ser	Asn	Ser	Ser	Pro	Asn	Asp	Val	Phe	Thr	Val	Ser	Asn	Tyr	80	85	90
Ser	Phe	Lys	Tyr	Glu	Asn	Asn	Pro	Phe	Leu	Gly	Phe	Ala	Gly	Ala	95	100	105
Ile	Gly	Tyr	Ser	Met	Asp	Gly	Pro	Arg	Ile	Glu	Leu	Glu	Val	Ser	110	115	120

Tyr	Glu	Thr	Phe	Asp	Val	Lys	Asn	Gln	Gly	Asn	Asn	Tyr	Lys	Asn	125	130	135
Glu	Ala	His	Arg	Tyr	Cys	Ala	Leu	Ser	His	Asn	Ser	Ala	Ala	Asp	140	145	150
Met	Ser	Ser	Ala	Ser	Asn	Asn	Phe	Val	Phe	Leu	Lys	Asn	Glu	Gly	155	160	165
Leu	Leu	Asp	Ile	Ser	Phe	Met	Leu	Asn	Ala	Cys	Tyr	Asp	Val	Val	170	175	180
Gly	Glu	Gly	Ile	Pro	Phe	Ser	Pro	Tyr	Ile	Cys	Ala	Gly	Ile	Gly	185	190	195
Thr	Asp	Leu	Val	Ser	Met	Phe	Glu	Ala	Thr	Asn	Pro	Lys	Ile	Ser	200	205	210
Tyr	Gln	Gly	Lys	Leu	Gly	Leu	Ser	Tyr	Ser	Ile	Ser	Pro	Glu	Ala	215	220	225
Ser	Val	Phe	Ile	Gly	Gly	His	Phe	His	Lys	Val	Ile	Gly	Asn	Glu	230	235	240
Phe	Arg	Asp	Ile	Pro	Thr	Ile	Ile	Pro	Thr	Gly	Ser	Thr	Leu	Ala	245	250	255
Gly	Lys	Gly	Asn	Tyr	Pro	Ala	Ile	Val	Ile	Leu	Asp	Val	Cys	His	260	265	270
Phe	Gly	Ile	Glu	Leu	Gly	Gly	Arg	Phe	Ala	Phe					275	280	

<210> 20

<211> 271

<212> PRT

<213> *Ehrlichia chaffeensis*

<220>

<223> P28-20 Outer Membrane Protein of  
*Ehrlichia chaffeensis*





Val Ser Val Asn Val Met Leu Phe Gly Gly Gly Tyr Tyr His Lys  
215 220 225

Val Ile Gly Asn Arg Tyr Glu Arg Val Glu Ile Ala Tyr His Pro  
230 235 240

Ala Thr Leu Thr Asn Val Pro Lys Thr Thr Ser Ala Ser Ala Thr  
245 250 255

Leu Asp Thr Asp Tyr Phe Gly Trp Glu Val Gly Met Arg Phe Thr  
260 265 270

Leu

<210> 21

<211> 279

<212> PRT

<213> *Ehrlichia chaffeensis*

<220>

<223> P28-21 Outer Membrane Protein of  
*Ehrlichia chaffeensis*

<400> 21

Met Arg Tyr Lys Asp Phe Ser Asn Asn Ile Asp Val Ile Ile Gly  
5 10 15

Thr Leu Val Gly Cys Phe Ser Gly Ser Leu Asp Val Ser Asp Ser  
20 25 30

Leu Asn Ser Arg Leu Lys Pro Val Phe Leu Gly Ile Ser Tyr Lys  
35 40 45

Leu Ser Ala Pro Leu Phe Ser Ser Phe Ser Ile Gly Glu Thr Tyr  
50 55 60

Arg Ile Asn Gly Val Lys Thr Asp Arg Val Val Gly Leu Lys Ser  
65 70 75

Asp	Ile	Leu	Leu	Asp	Ala	Asp	Lys	Ala	Met	Lys	Asp	Phe	Asn	Asn	
				80					85					90	
Phe	Asn	Phe	Ser	Glu	Glu	Tyr	Val	Pro	Lys	Tyr	Asp	Asn	Asn	Ile	
				95					100					105	
Phe	Gly	Leu	Ser	Phe	Ile	Phe	Gly	Tyr	Ser	Phe	Arg	Asn	Leu	Arg	
				110					115					120	
Val	Glu	Leu	Glu	Gly	Ser	Tyr	Lys	Lys	Phe	Asp	Val	Ile	Asp	Thr	
				125					130					135	
Arg	Asn	His	Leu	Val	Asp	Asn	Asn	Tyr	Arg	His	Ile	Ala	Leu	Val	
				140					145					150	
Arg	Ser	Asn	Pro	Pro	Thr	Leu	Tyr	Asp	Tyr	Phe	Val	Leu	Lys	Asn	
				155					160					165	
Asp	Gly	Val	Glu	Phe	Tyr	Ser	Thr	Ile	Leu	Asn	Ile	Cys	Tyr	Asp	
				170					175					180	
Phe	Ala	Val	Asp	Thr	Asn	Ile	Val	Pro	Phe	Ser	Cys	Val	Gly	Ile	
				185					190					195	
Gly	Glu	Asp	Ile	Ile	Lys	Ile	Phe	Asp	Ser	Ile	Arg	Phe	Lys	Pro	
				200					205					210	
Ser	Phe	Asn	Ser	Lys	Leu	Gly	Ile	Asn	Tyr	Leu	Met	Ser	Gln	Asp	
				215					220					225	
Met	Leu	Leu	Phe	Phe	Asp	Val	Tyr	Tyr	His	Arg	Val	Val	Gly	Asn	
				230					235					240	
Glu	Tyr	Asn	Asn	Ile	Pro	Val	Gln	Tyr	Val	Ser	Leu	Pro	Asn	Pro	
				245					250					255	
Leu	Asn	Ile	Ser	Thr	Ala	Ala	Lys	Leu	Asp	Met	Glu	Tyr	Phe	Gly	
				260					265					270	
Ala	Glu	Ile	Gly	Ile	Lys	Val	Phe	Val							
				275											

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 <400> 22  
 acgtgatatg gaaagcaaca agt 23

<210> 23  
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 <212> DNA  
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 <223> P28-10 reverse primer  
 <400> 23  
 gcgccgaaat atccaaca 18

<210> 24  
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 <400> 24  
 ggtcaaactt gccctaaaca ca 22

<210> 25  
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 <223> P28-11 reverse primer  
 <400> 25  
 acttcaccac caaaataccc aata 24

<210> 26  
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 <400> 26  
 ctgctggcat tagttaccc 19

<210> 27  
 <211> 17  
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 <223> P28-12 reverse primer  
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 catagcagcc attgacc 17

<210> 28  
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 <400> 28

attgattgcc tattacttga tgggt 24

<210> 29  
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 <400> 29

aatggggctg ttggttactc 20

<210> 30  
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tgaagacgca atagcagata aga 23

<210> 31  
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 <400> 31

tagcgcagat gtggtttgag 20

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actgtcgcgt tgtatggttt g 21

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attagtgctg cttgctttac ga 22

<210> 34  
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 tgcaaggtga caatattagt ggta 24

<210> 35  
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<210> 36  
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 acattttggc gtattctctg c 21



<210> 37  
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<210> 38  
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ctgaaggagg agaaagccat aagt 24

<210> 42  
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accaaagtat gcaatgtcaa gtg 23

<210> 43  
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ctgcagatgt gactttagga gattc 25

<210> 44  
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tgtatatctt ccagggtctt tga 23

<210> 45  
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gaccattcta cctcaacc 18

<210> 46  
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 <400> 50

tgacagattga tgtggatggt t 21

<210> 51  
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gtaaaacaca agccaccagt ct 22

<210> 52  
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 <400> 52

gggcatatac ctacaccaaa cacc 24

<210> 53  
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 <400> 53

taagaggatt gggtaggat a 21